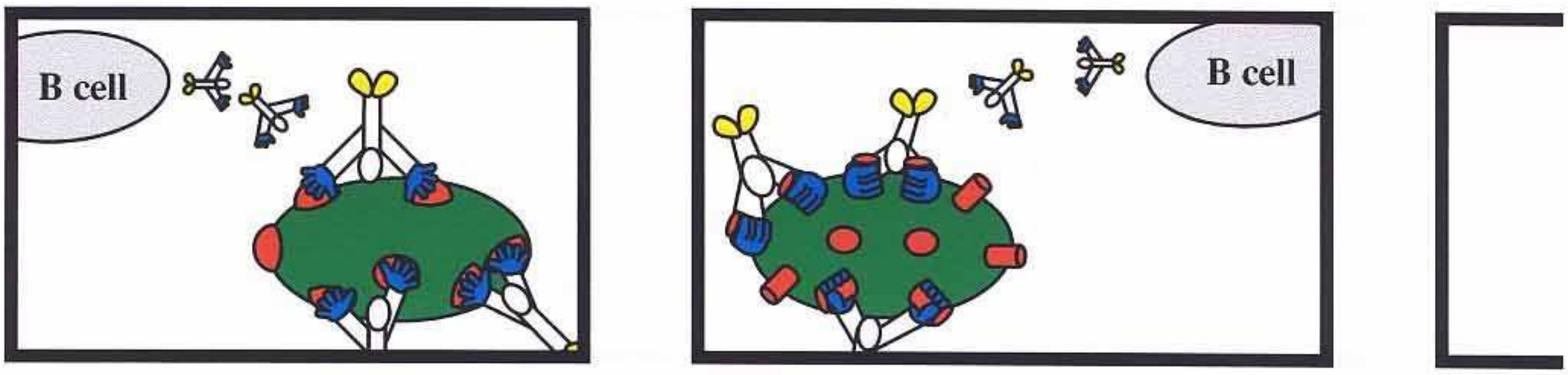
CHAPTER THIRTEEN

THE EXTENDED ROLE OF ANTIBODIES

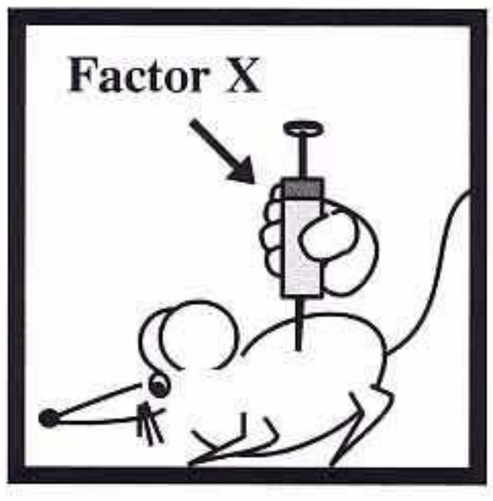


Antibodies will have the same shaped 'hands' as the B cell which released them, as shown on page 63.

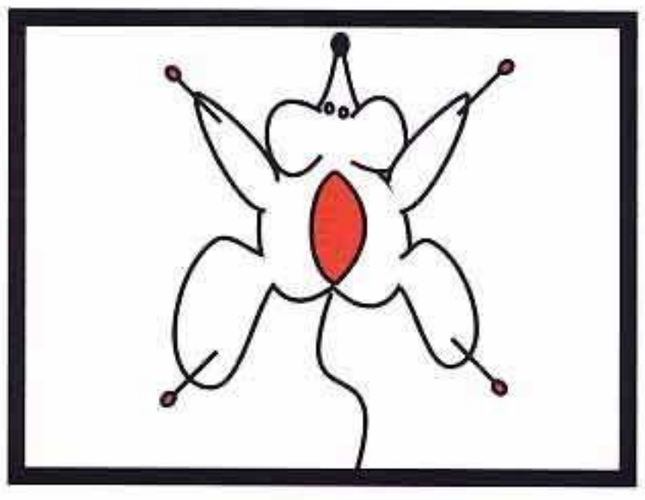
Easy reading

Technical information

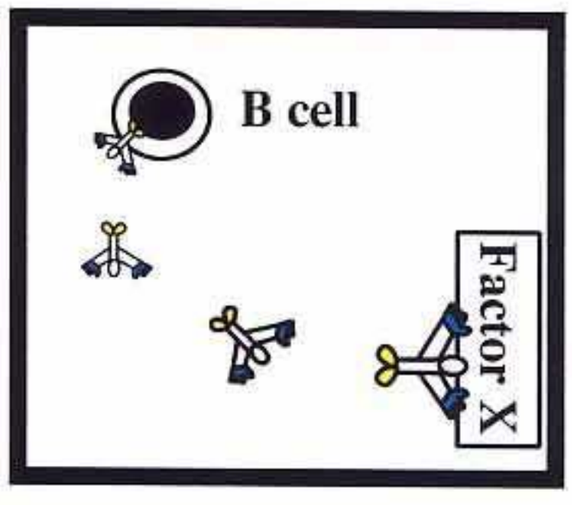
But how do you find a B cell that produces antibodies, which have a 'hand' shape that fits what you want?



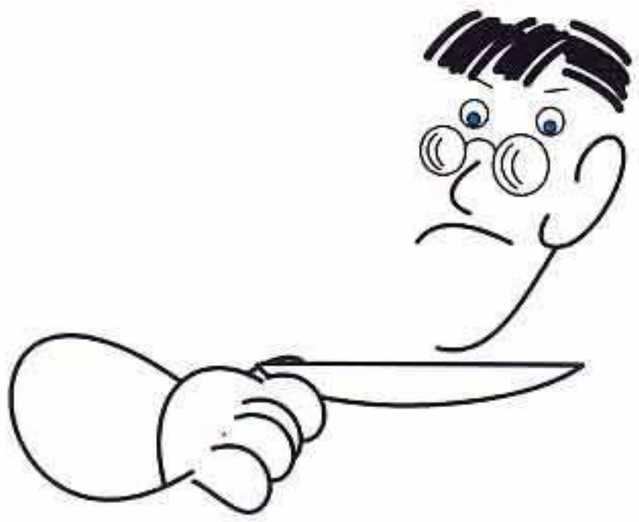
A mouse is injected with factor X.



2 weeks later it is killed and organs containing B cells like the spleen, are removed.

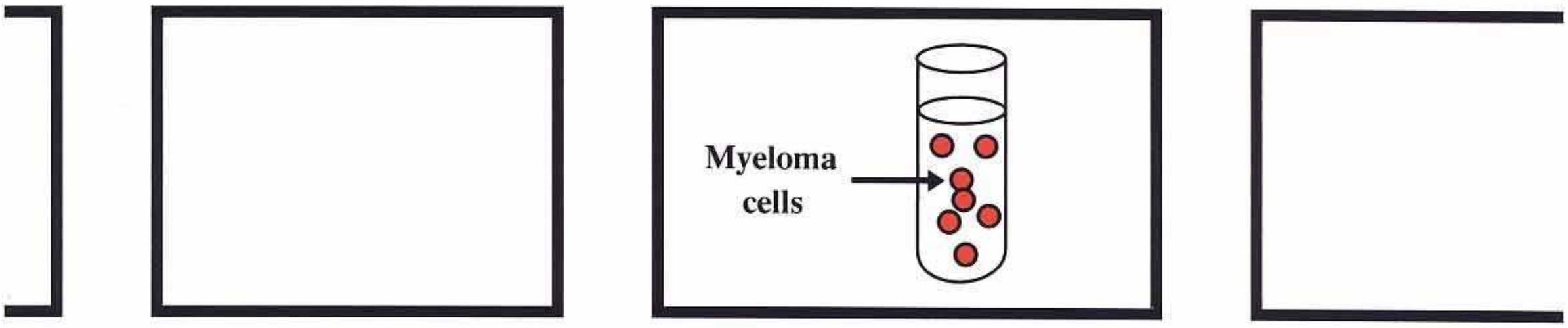


This mouse B cell, is releasing antibodies with 'hands' that 'fit' factor X.

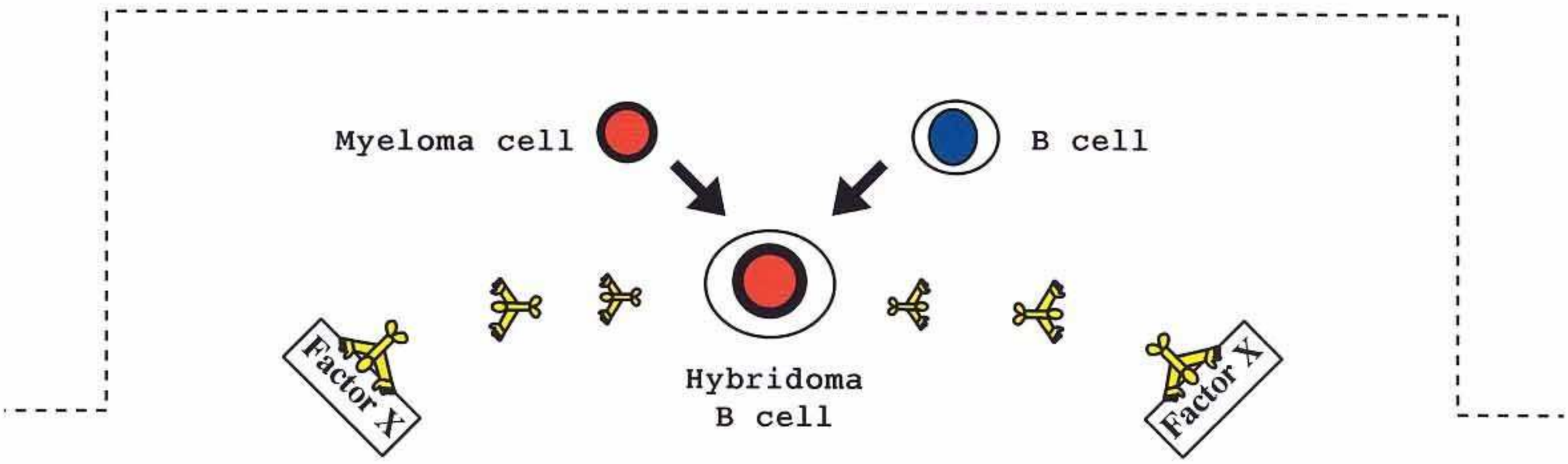


Unfortunately, when kept in an artifical environment, B cells like all normal cells will die after only a few days.

HYBRIDOMA B CELLS

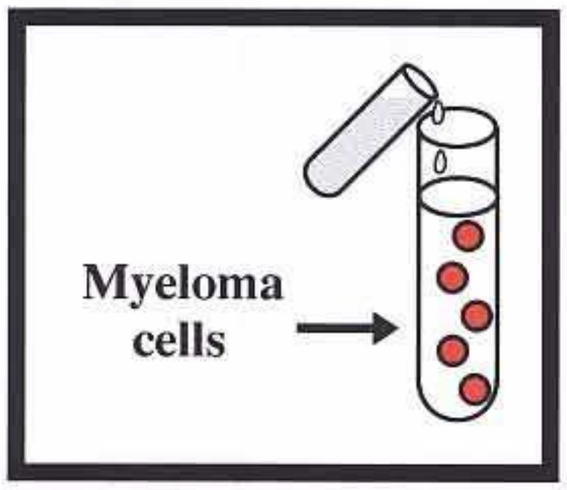


But cancer cells, like these myeloma cells, are able to survive indefinitely in an artificial medium.

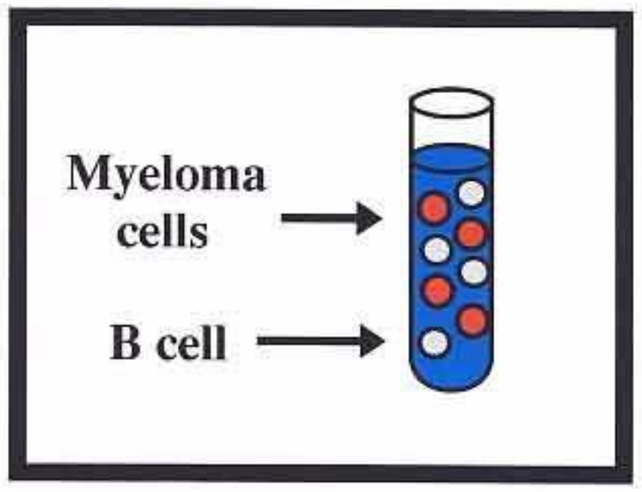


So by fusing a myeloma and B cell together, you end up with a hybridoma B cell. This cell will live indefinitely and make antibodies with 'hands' that fit a known substance.

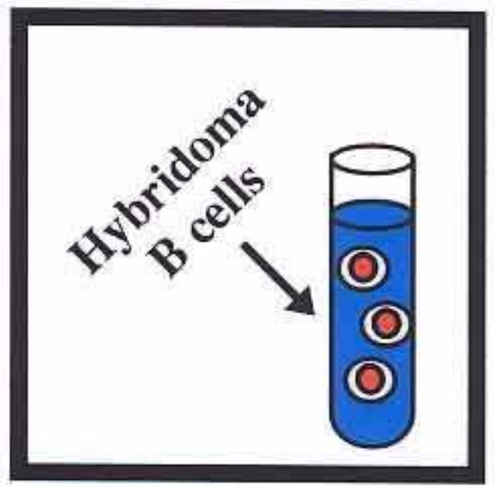
HOW TO FORCE THE MYELOMA AND B CELL TO FUSE



First the myeloma cells have their TK & HGPRT enzymes destroyed.



The treated myeloma cells are then placed in a HAT solution, along with B cells.



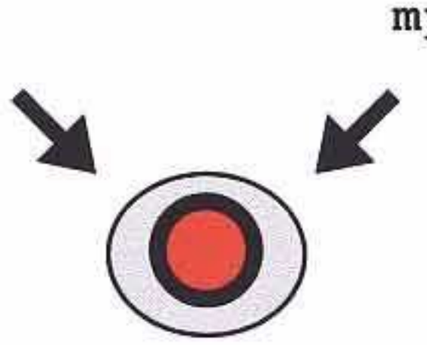
A couple of weeks later, only hybridoma B cells are left.

HGPRT : Hypoxanthine - guanine phosphoribosyl transferase
TK : Thymidine kinase
HAT : Hypoxanthine, aminopterin and thymidine

WHY DO THESE 2 CELLS FUSE TOGETHER?

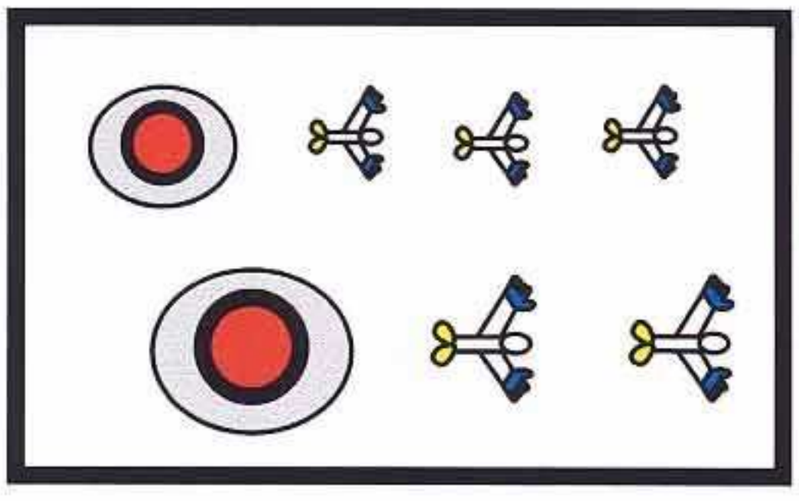
A myeloma cell needs the TK and HGPRT enzymes from the B cell to survive.

The B cell needs the immortality of the myeloma cell to survive.

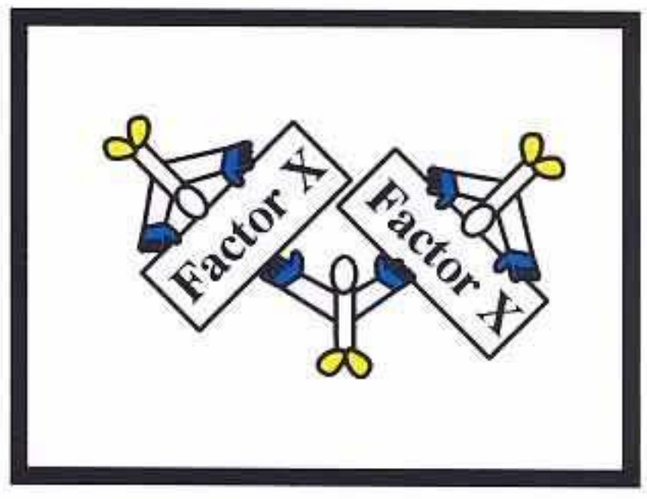


Hybridoma B cell

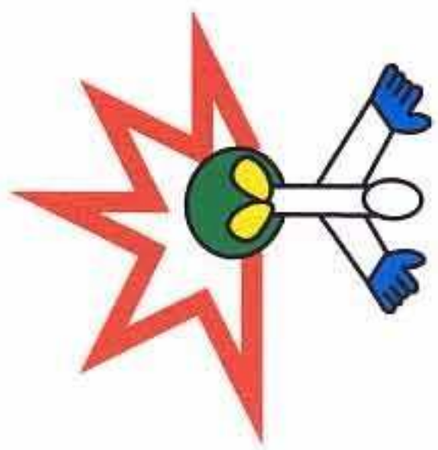
MONOCLONAL ANTIBODIES



Clones from the original hybridoma B cell, will all release antibodies with 'hands' that 'fit' the same thing.

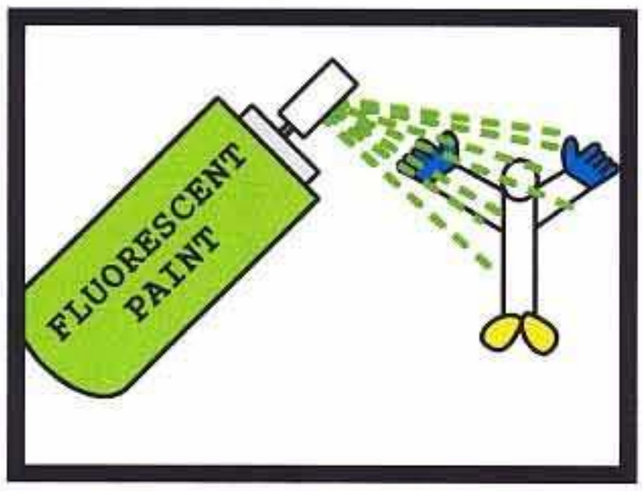


Hence, the antibodies from a hybridoma B cell are called "monoclonal antibodies".

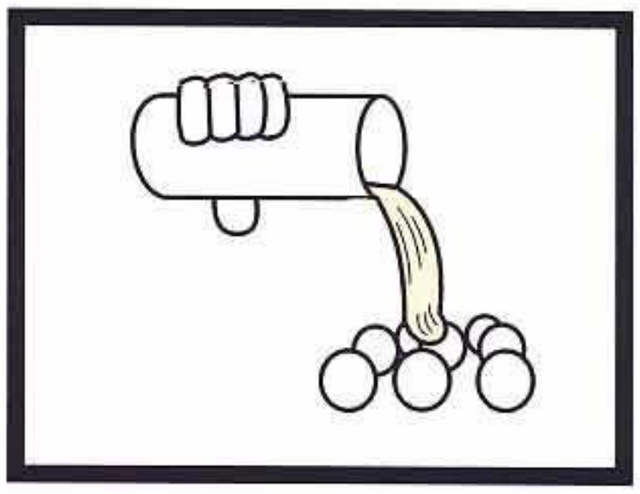


Fluorescent, radioactive or enzyme materials, can all be attached to the 'body' of an antibody and have no effect on their 'hands'.

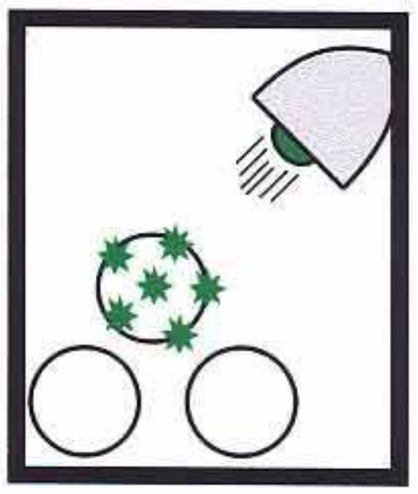
LABELLING



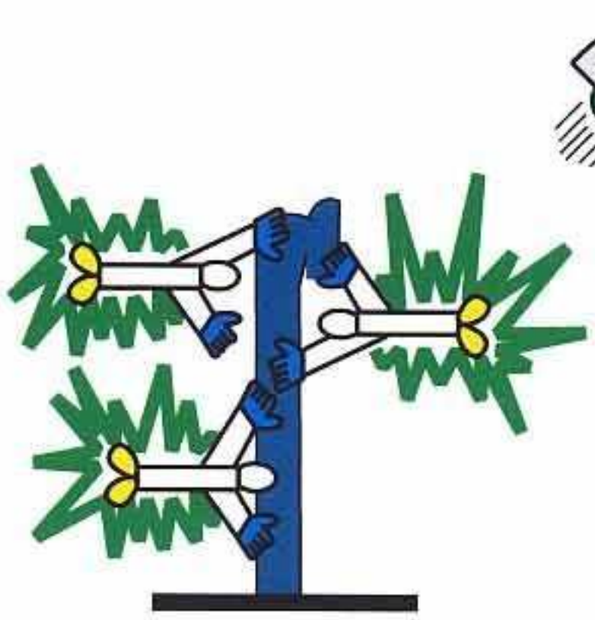
Some monoclonal antibodies, with 'hands' that fit the CD4 molecule, are labelled with fluorescent material.



Fluid containing the labelled IgG, is then applied to these cells to see if any of them are T helper lymphocytes.

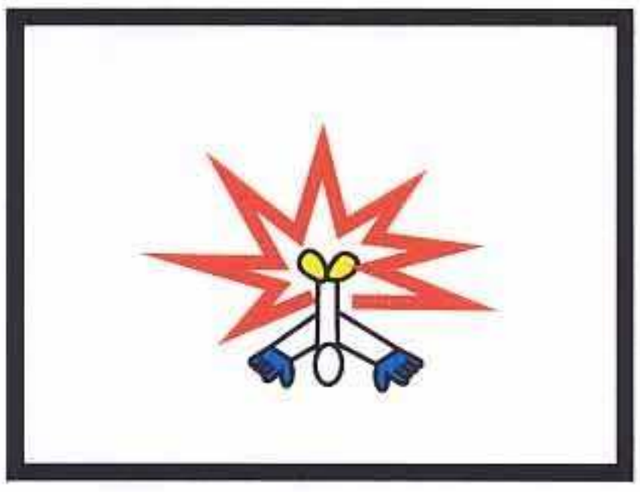


One of the cells now glows under ultraviolet light.



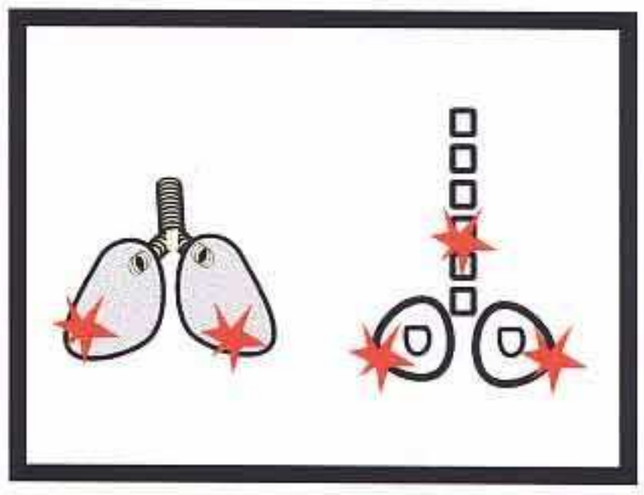
Here a CD4 molecule has been enlarged to show the labelled IgG.

MAGIC BULLET OR RUSSIAN ROULETTE?



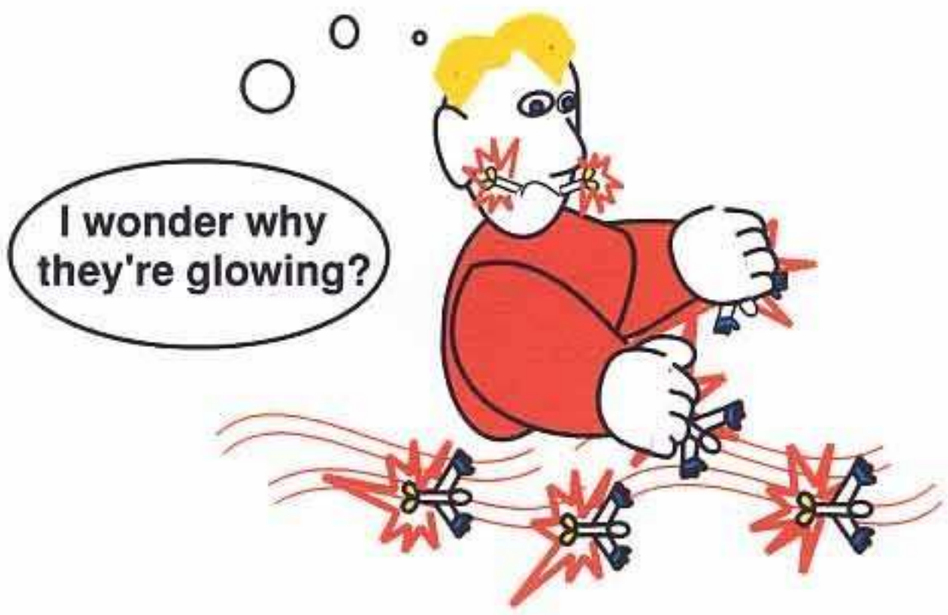
Monoclonal antibodies with 'hands'that 'fit' a particular cancer, have a radioactive isotope attached.

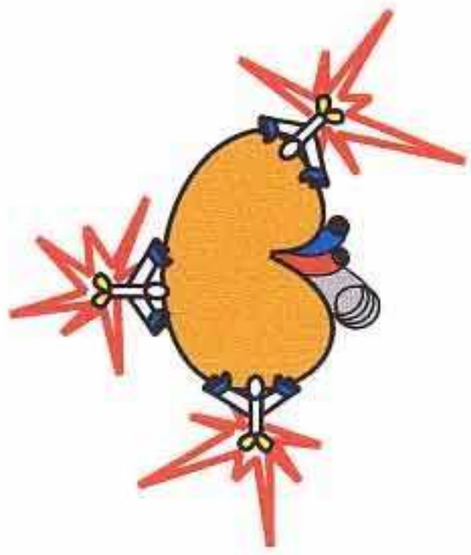
These are then given to the patient.



Hopefully they will attach onto the tumour and any secondaries and kill them.

HOWEVER!!!



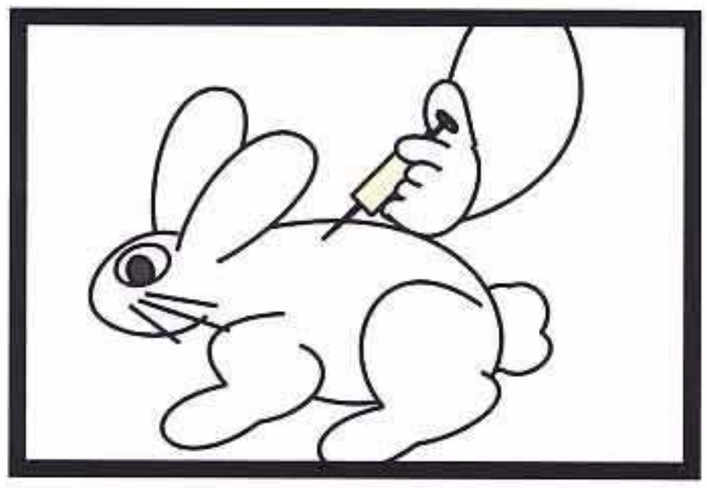


The labelled antibodies could kill resident macrophages, who may 'eat' them as they are foreign material.

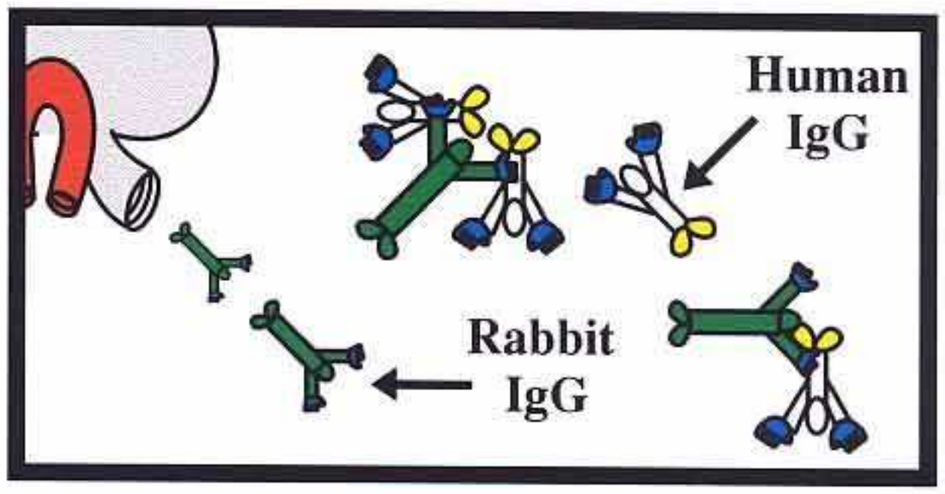
And if their 'hands' happen to fit any normal cells, then these too might be killed.

THE COOMBS' TEST

This test which has many applications, uses antibodies made inside an animal which have 'hands' that 'fit' human antibodies.

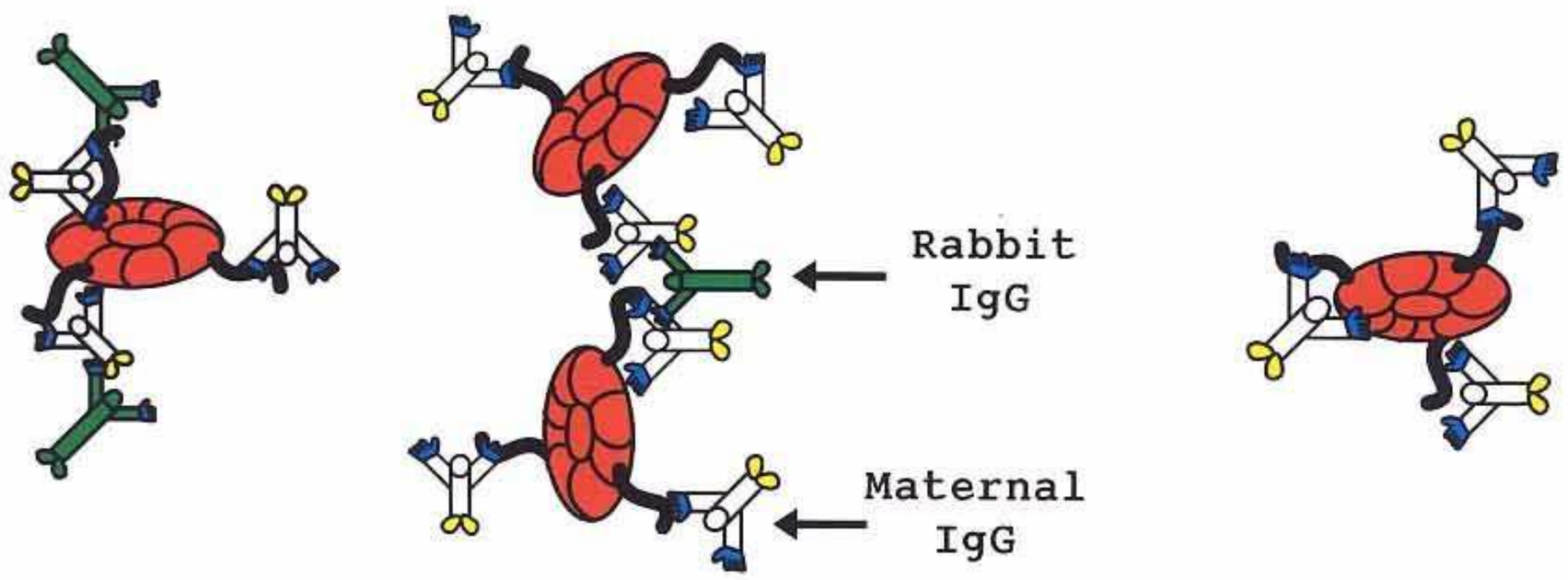


Human antibodies are injected into an animal such as a rabbit.



A couple of weeks later and the rabbit's immune system starts making antibodies, to eliminate the human antibodies.

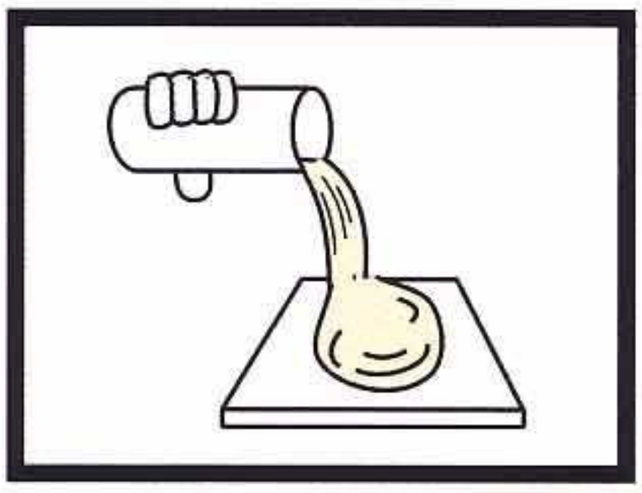
These anti-human antibodies are now extracted from the animal.



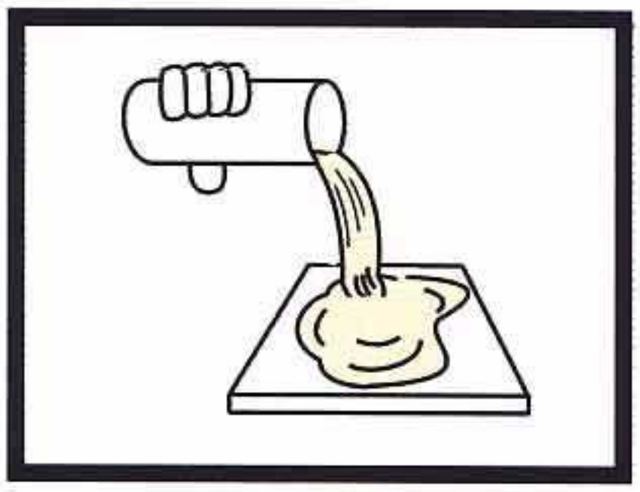
If blood from a 'blue baby' (see page 172) clumps when a Coombs' test is conducted, it shows that the problem is due to the mother making anti-rhesus antibodies.

ONE OF THE TESTS FOR AIDS

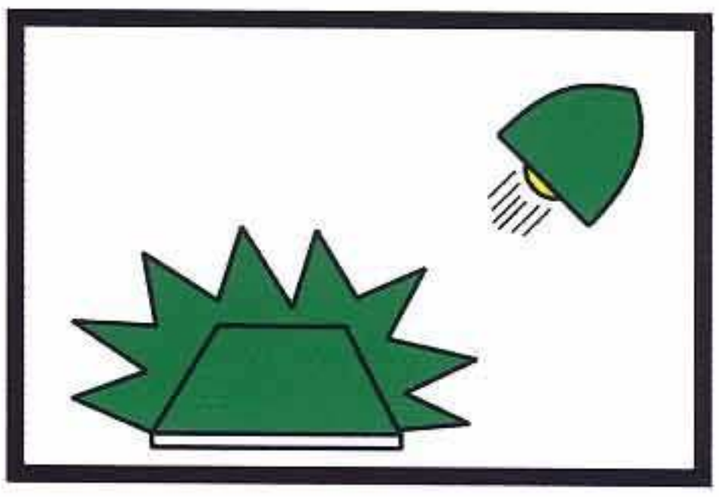
A couple of weeks after becoming infected by this virus, anti-AIDS antibodies will start to appear in the patient's blood.



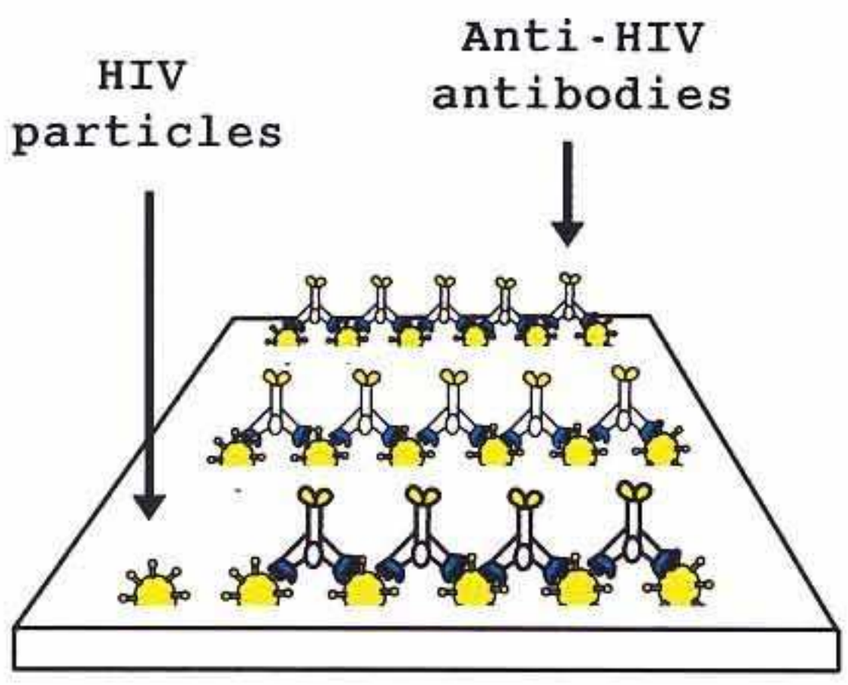
Serum from the patient is applied to a gel impregnated with the AIDS virus.



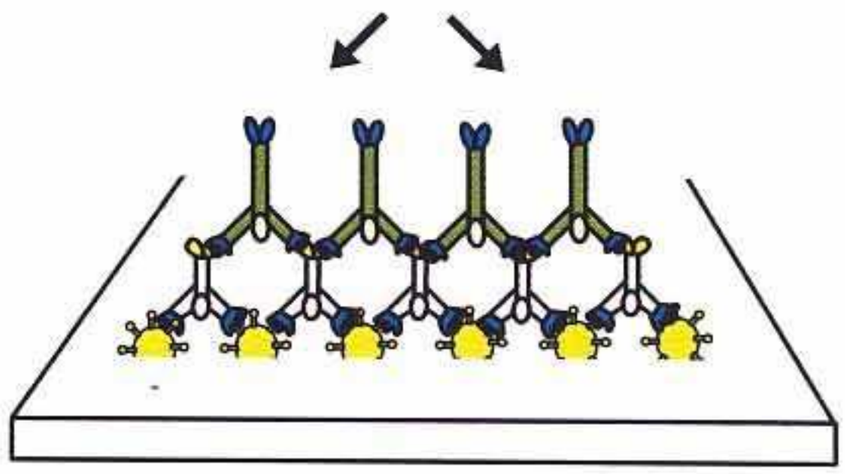
Fluorescent labelled anti-human antibodies, are then applied to the gel.



If the gel now fluoresces under ultraviolet light, the patient is infected with the AIDS virus.

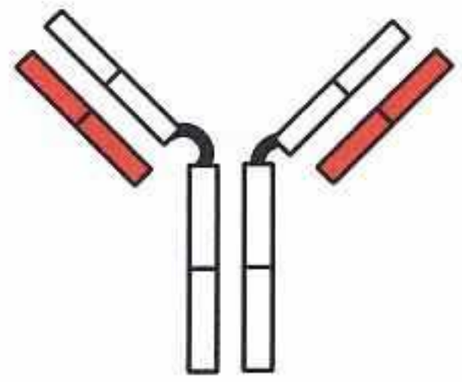


A person infected with the AIDS virus, will have antibodies in their blood, which will attach onto the HIV particles in the gel.

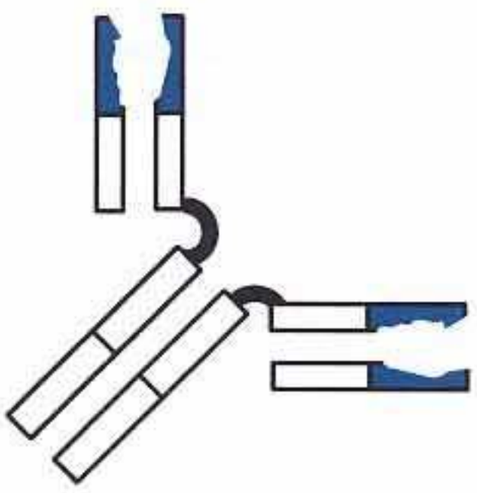


Note how the fluorescent labelled sheep antibodies, can now attach onto the anti-HIV antibodies.

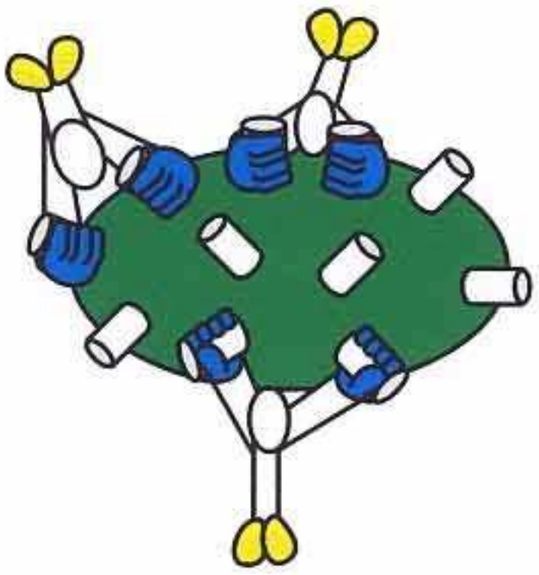
A BIT OF JARGON



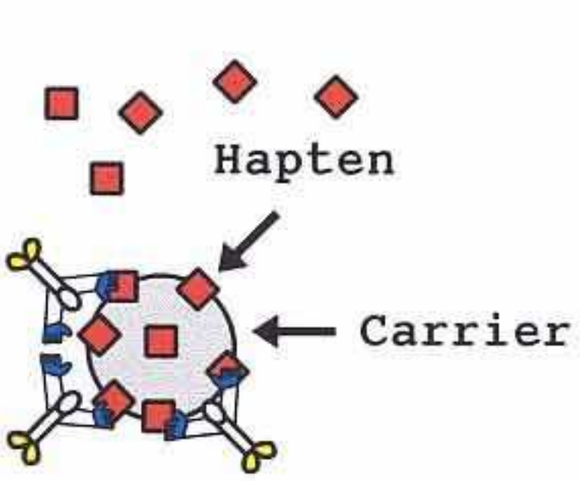
Although there are actually 2 types of antibody light chain called "kappa" and "lambda", a B cell is only able to make one or the other, never both.



A paratope is the technical name given to the part of the antibody's 'hand', that fits around something.



An epitope is the part (shape) that the antibody's 'hand' fits around.



A hapten is a particle which is too small to elicit an antibody response, until it is attached onto a larger carrier molecule.